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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/566,163	06/07/2006	Thomas Frey	1454.1649	2505

21171 7590 06/25/2009
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EXAMINER	
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ART UNIT	PAPER NUMBER
2611	

MAIL DATE	DELIVERY MODE
06/25/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/566,163	FREY ET AL.	
	Examiner	Art Unit	
	ADOLF DSOUZA	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6/7/2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10 - 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10 - 13, 18 - 19, 23 - 24* is/are rejected.

7)☒ Claim(s) *14 - 17, 20 - 22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Priority

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d).

Specification

2. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

3. The abstract of the disclosure is objected to because it uses legal phraseology. The word "said" appears several time sin the abstract. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 10 – 12, 18, 23, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kiessling et al. (Performance analysis of MIMO maximum likelihood receivers with channel correlation, colored Gaussian noise, and linear prefiltering; May 11 – 15, 2003; IEEE Conference on Communications; pages 3026 – 3030; which the Applicant has provided in his IDS) in view of Klimovitch (US 20020111142).

Regarding claim 10, Kiessling discloses a method for pre-filtering used for a channel estimation of radio transmission characteristics in a radio communication system, in which an antenna arrangement having a plurality of antenna elements is used on a transmit side (Abstract, 1st sentence; page 3026, section I, in particular 1st, 2nd and last paragraphs; page 3027, Equation (3); wherein the plurality of antennas is interpreted as the MIMO link; the prefiltering is done by the prefiltering matrix on the transmitter side and the channel estimation is done by Equation (3)), comprising:

feeding the training sequences via a pre-filter to the antenna elements on the transmit side (Abstract, 1st sentence; page 3026, section I, in particular 1st, 2nd and last paragraphs; section II; Fig. 1; wherein the prefilter is shown as block "F" in Fig. 1 and the antenna elements are in the MIMO system);

receiving after transmission and using the training sequences to estimate radio transmission characteristics, which are described by spatial correlations (Fig.1, receiver shown as the last 2 blocks; page 3027,Equation (3) which shows how the radio channel is estimated);

using the pre-filter to adjust the data radio transmission channel characteristics, to thereby improve the channel estimation (Fig. 1; page 3027,Equation (3); sections I – II; wherein the prefilter adjusts the data to the radio channel characteristics);

dimensioning the pre-filter as a function of the spatial correlations (page 3027, left column, 1st 5 lines, including Equation (1); wherein dimensioning the prefilter is interpreted as selecting the prefilter matrix size to make it compatible with the channel matrix size, and therefore channel length so that a proper matrix multiplication can be made in Equation (1)) to achieve a predefined error value of an algorithm used for channel estimation.

Kiessling does not disclose that the above is done on a training sequence (but on data) and also does not disclose that a predefined error value of an algorithm is used for channel estimation.

In the same field of endeavor, however, Klimovitch discloses a training sequence is used and that a predefined error value of an algorithm is used for channel estimation (Abstract; [0003]; [0005]; [0009]; [0022]; wherein a training sequence is used for channel estimation; [0038]; [0041]; wherein the predefined error value of an algorithm is used for channel estimation is the MMSE criterion).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the training sequence and the MMSE criterion, as taught by Klimovitch, in the system of Kiessling because using the training sequence

would allow the channel to be estimated more rapidly than using data and a MMSE criterion results in the best solution in a mean square sense.

Regarding claim 11, Kiessling does not disclose the predefined error value is a receive-side error value, and the predefined error value is a minimum error value which is defined based on a length of the training sequences, or the predefined error value is achieved by adjusting the length of the training sequences.

In the same field of endeavor, however, Klimovitch discloses the predefined error value is a receive-side error value ([0038]; wherein the estimator is used on the receiver side to estimate the channel response), and the predefined error value is a minimum error value ([0038]; [0041]; wherein the predefined value being the minimum value is interpreted as the MMSE criterion) which is defined based on a length of the training sequences, or the predefined error value is achieved by adjusting the length of the training sequences ([0031]; [0042]; [0043]; wherein the length of the training sequence is interpreted as the block length).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the MMSE criterion, as taught by Klimovitch, in the system of Kiessling because using a MMSE criterion results in the best solution in a mean square sense.

Regarding claim 12, Kiessling does not disclose an MSE algorithm is used to estimate the radio channel characteristics on a receive side.

In the same field of endeavor, however, Klimovitch discloses an MSE algorithm is used to estimate the radio channel characteristics on a receive side ([0038]; [0041]).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the MMSE criterion, as taught by Klimovitch, in the system of Kiessling because using a MMSE criterion results in the best solution in a mean square sense.

Regarding claim 18, Kiessling does not disclose an MSE algorithm is used to estimate the radio channel characteristics on a receive side.

In the same field of endeavor, however, Klimovitch discloses an MSE algorithm is used to estimate the radio channel characteristics on a receive side ([0038]; [0041]).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the MMSE criterion, as taught by Klimovitch, in the system of Kiessling because using a MMSE criterion results in the best solution in a mean square sense.

Regarding claim 23, Kiessling discloses a transmit station and/or a receive station of a radio communication system which are embodied to implement the method according to claim 10 (Abstract, 1st sentence; section I, 1st3 paragraphs).

Claim 24 is directed to apparatus of the same subject matter claimed in method/steps claim 10 and therefore, is rejected as explained in the rejection of claim 10 above.

6. Claim 13, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kiessling et al. (Performance analysis of MIMO maximum likelihood receivers with channel correlation, colored Gaussian noise, and linear prefiltering; May 11 – 15, 2003; IEEE Conference on Communications; pages 3026 – 3030; which the Applicant has provided in his IDS) in view of Klimovitch (US 20020111142) as applied to claim 10 above, and further in view of Dent (US 20030054828)

Regarding claim 13, Kiessling does not disclose beamforming is implemented by the prefilter.

In the same field of endeavor, however, Dent discloses a beam forming method is implemented by the pre-filter for every training sequence, and in the beam forming method, the pre-filter assigns both a power and an antenna element to each training sequence ([0044]; [0047] – [0055]; Fig. 1, element 20; wherein the beamforming implemented by the prefilter is interpreted as the beamforming weights being calculated by numerical processor 20 as described in the paragraphs above).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use beamforming weights, as taught by Dent, in the system of Kiessling because this would allow for directional transmission, as is well known in the art.

Regarding claim 19, Kiessling does not disclose beamforming is implemented by the prefilter.

In the same field of endeavor, however, Dent discloses a beam forming method is implemented by the pre-filter for every training sequence, and in the beam forming method, the pre-filter assigns both a power and an antenna element to each training sequence ([0044]; [0047] – [0055]; Fig. 1, element 20; wherein the beamforming implemented by the prefilter is interpreted as the beamforming weights being calculated by numerical processor 20 as described in the paragraphs above).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use beamforming weights, as taught by Dent, in the system of Kiessling because this would allow for directional transmission, as is well known in the art.

Allowable Subject Matter

7. Claims 14 – 17, 20 - 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Regarding claims 14 and 20, the prior art fails to disclose the training sequence is prefiltered based on the equation:

$$F \cdot S = V_{Tx}^{*} \Phi_f S$$

Claims 15 – 17 and 21- 22 are objected to being allowable as they are dependent (directly on indirectly) on claims 14 and 20 respectively.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to channel estimation and prefiltering in MIMO systems:

Ranta et al. (US 20020173336) disclose a method for increasing data transmission rate, and receiver, transmitter and terminal.

Dent (US 20030045297) discloses a communication system employing channel estimation loop-back signals.

Dent et al. (US 20030036359) discloses a mobile station loop-back signal processing.

Havener et al. (US 6,381,504) discloses a method for optimizing a plant with multiple inputs that uses prefiltering.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADOLF DSOUZA whose telephone number is (571)272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Adolf DSouza
Examiner
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